From the Author

1573

REFLECTIONS
ON THE NATURE OF
LIGHT AND FIRE.

BRITISH MUSEUM

REFLECTIONS

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ON THE NATURE OF

LIGHT and FIRE:

WHEREIN
The received Opinion of the SUN's
HEAT, is attempted to be refuted by
NATURAL and PHILOSOPHICAL
OBSERVATIONS.

LONDON,
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MDCCLXXXIII.

Thomas Cuſsans Esq.

BRITISH MUSEUM

DEDICATION.

To the Moſt Illuſtrious the EMPRESS
of all the RUSSIAS, *&c.*

IF the following obſervations can be conducive to the advantages of Science, the homage of the Author is due to the Illuſtrious PROTECTRESS of it's welfare; if not, in no inſtance can ambition be ſo eaſily pardoned, as in the zeal of ſigning himſelf,

Moſt Illuſtrious PRINCESS,

Your devoted and obſequious ſervant,

THE AUTHOR.

PREFACE.

THE Author, induced by the deſire of his friends to lay before the public ſome looſe thoughts upon the nature and qualities of light, has thought it proper to apologize to the public for an attempt ſo new in itſelf, at the ſame time ſo different from the received aphoriſms of philoſophy and mankind; he muſt vindicate the extravagance of the action on the beſt grounds the ſubject will admit, whether from ancient records, ſacred or profane, or modern information: how far back may be traced the firſt ſteps of Science he is not ſo informed as to ſay, but it is moſt certain, that long before the period of Ariſtotle's works, ſcience had made a figure in the world; this great philoſopher ſeems to have been the great luminary of his day, as he oppoſed all antecedent opinions, and had abilities to engraft his own upon the minds of his cotemporaries; it appears to the author, that ſcience received a check at that time; the hypotheſis and aphoriſms of Ariſtotle were received axioms. Oppoſition would have entailed ridicule on the opponents of his doctrine, the only means of being admitted into the circle of ſcience, was to adhere to his tenets and principles; and wonderful as it may appear, yet true, that the abſurdities of this great man, have triumphed over the abilities of mankind almoſt to the preſent century. Subſequent philoſophers however combated his opinion, the reſult was ſceptiſciſm; for their arguments againſt the opinion of Ariſtotle, were as hurtful to themſelves as him; they had detected errors in his writings, his fallibility confirmed by the philoſophy of the day, as that ſame philoſophy was afterwards by the ſubſequent doctrine of ſceptiſciſm; each had diſcovered the light of truth, which, like the tranſitory light of day, cloſed with the ſetting ſun, and left the world in darkneſs; a variety of circumſtances, ſuch as the Author is not qualified to account for, kept the world in total ignorance till about the fifteenth century, when ſcience ſeems again to have emerged, and truth was inveſtigated in all its moſt ſecret receſſes, yet was no where to be found in all the extended range of ſcience, nor perhaps ever will, for obvious reaſons; yet ſufficient to urge us to the purſuit, and make us happy; though truth is univerſal, yet the variety of contingences to inveſtigate it from the ſource, the reference it has to every thing, and every body, makes the means of obtaining it ſo liable to error, that it is hardly to be found: as error ſeems the natural conſequence of the inveſtigation of truth, the Author is tempted to define it for the purpoſes of the ſubject he is about to diſcuſs; truth is in its ſtate and nature always the ſame, nor reaſon, circumſtances, or the nature of things, can make it other than it is in all circumſtances and references whatever. This general idea of truth, can only hold good with the mathematics, and ſcriptural truths founded on revelation; the other ſubdiviſions of truth may be comprehended under the three following heads, viz. Judicial, Moral, and Philoſophical; as to the firſt, the difficulty of proceeding in our Courts of Law and Equity, where truth is inveſtigated with the utmoſt preciſion and attention, yet, notwithſtanding the integrity of the evidence, miſapprehenſion of words, miſrecollection of facts, or other circumſtances, make the verdicts ſometimes erroneous. Moral truth depends upon the integrity and character of the evidence, which may be erroneous by the evidence not being always what he would ſeem; as to philoſophical truth, it is now what it always has been, and always muſt be, ſubject to error, for many obvious reaſons. The hypotheſis may be falſe, or the induction ſtrained; yet, for the honour of ſcience, natural truths have been diſcovered, and clearly proved by the immutable proofs of the mathematics; yet many things are advanced as truths, which perhaps the experience of a few years will diſcover to be erroneous: Belief is to ſcience as injurious, as unbelief to religion. The aphoriſms of the great Newton have been the principles of all his ſucceſſors; his aſtoniſhing ſuperiority of abilities (in perhaps the moſt enlightened age of the world) over his cotemporaries, who ſeemed to oppoſe his principles but to advance his glory, plead in excuſe of the implicit faith put in him by the reſt of mankind: yet Newton was a man, though his reaſon and judgment were ſuperior perhaps to any of any nation, or period of time. But where he founds his effects from hypotheſes, and thoſe not proved to demonſtration, men may be excuſed doubting, when facts are not proved to the ſatisfaction of their ſenſes. Syſtems even to the preſent times have changed, what was received as orthodox a thouſand years ago, would in this age be ridiculed. Ptolemy and Copernicus have each triumphed, the latter's glory may have a period as well as the former, and a new age produce new lights. 'Tis upon the plea of the inſtability of ſcience, the author wiſhes to apologize to the pulic for having advanced what may appear ridiculous, as being new; and abſurd, as never having been thought of before: the author, rather from a deſire of being informed by obviating what he has ſaid, than from advancing abſurdities upon the public, (which they may not underſtand) to inſtruct; with this apology he ſubmits his thoughts, with all due reſpect, to the public. Concluding with a few lines from a moſt reſpectable author, to palliate the raſhneſs of his attempt: "The imputation of novelty is a terrible charge among thoſe who judge of men's heads as they do of their perukes, by the faſhion; and can allow none to be right but the received doctrines." Truth ſcarce ever carried it by vote any where by its firſt appearance; new opinions are always ſuſpected, and uſually oppoſed, without any other reaſon, but becauſe they are not already common: but truth, like gold, is not the leaſt ſo by being newly brought out of the mine, it is trial and examination muſt give it price, and not any antique faſhion; and though it may not yet be current by the public ſtamp, yet it may be for all that as old as nature, and not the leſs genuine.

"*Candidus imperti ſi non his utere mecum.*"

REFLECTIONS

ON

LIGHT AND HEAT, &c.

IF Philoſophy is the attainment of wiſdom, the means to obtain it are obvious, by conſidering the creation in all its viſible productions, and inviſible powers, to trace the chain of effects to its original cauſe; or, from an apparent hypotheſis, prove its probability from induction of effects. As the views of philoſophy are the diſcovery of truth, where experiment and right reaſon unite, belief is moſt likely to be grounded on that baſis, though conviction from effect will often make us err in the nature of the cauſe; which I ſhall endeavour to ſhew in the following ſheets. The ancient Pagan philoſophy has been long ſince very ſenſibly exploded, though many of their maxims are retained to the preſent times; though I do not believe them, I am not ſo bold as to ſay they are not to be credited. I ſhall give my objections of their authenticity to the public opinion, to judge of as they may think proper. It would ſeem from ancient as well as modern philoſophy, that the ſupreme Being acted with the diſcretion of a modern architect, before he began his works he had collected all his materials, that nothing might be wanting to the completion of his intention: the ſyſtem of elements ſhews that ſomething was antecedent to the creation; viz. the elements themſelves, if the creation is formed from the elements, the elements were antecedent; if the elements co-exiſted with the creation, the

Creator's works ſeem complicated, and compounded, and inferior to the ideas of a Being, whoſe will we muſt ſuppoſe perfect in every part of his works. I am ſenſible of the objection that might be made, if I mentioned Moſes as an inſpired writer in his account of the creation, as given in Geneſis; but, ſuppoſe a philoſopher had advanced his tenets, if the light of apparent truth ſhould be conſpicuous in the performance; if right reaſon and experiment ſhould prove the probability of truth in his works, better than the ſyſtem of any other perſon, it would be futile to object to him as an inſpired writer, if the principles of nature are better proved by him than by any other. I ſhall endeavour to prove, that this hypotheſis is better founded in reaſon and effect than that of any philoſopher ancient or modern, without availing myſelf of his miſſion, or inſpiration. It appears from the firſt chapter of Geneſis, that Moſes had an idea of an ens, or elementary principle in nature; for he ſays, "in the beginning the heavens and earth were created;" he then deſcribes the nature of the earth in chaos, that it was an unformed maſs, "and the ſpirit of God moved upon the face of the waters;" this ſeems, by his account, antecedent to the creation: the firſt order of the ſupreme Being was, "Let there be light, and there was light;" this was the firſt day's work. I ſhall endeavour to prove from the foregoing lines, the hypotheſis of many elements, unnatural, unreaſonable, and ineffectual. In all the ſubſequent days work we do not hear of the creation of fire, air, or earth, the ſuppoſed elements of the creation; yet we know theſe exiſt, not as cauſes, but effects; which I hope hereafter to prove to the ſatisfaction of the reader. The ſecond day's work, was the firmament; the third, the ſeparating the earth from the water, or modifying the chaos, "without form, and void," as expreſſed in Geneſis. The fourth day's creation, was that of the ſun, the great occult principle of all nature, on which depends the exiſtence of many things not created, but the effect of that creation. From the idea of Moſes, the creation by the ſeparation of earth from water, earth or water muſt then be the element, the principle of all ſubſequent formations. I ſhall endeavour to prove, that water is the eſſential principle of exiſtence in all ſubſequent modification of matter; quatenus matter, and that ſupported by the influence of the ſun, and pre-exiſting cold, have produced by their effects what did not ſpecifically exiſt at the creation; this hypotheſis raiſes in our minds the conſummate wiſdom of the Creator, by the ſimplicity of the work, more than by conceiving a complication of elementary principles for the completion of the ſyſtem. If water is the element, it muſt be proved that all the ſuppoſed elements can be produced from water, as fire, air, and earth. That water produces earth, is demonſtrable and evident in very many experiments; water may be evaporated till reduced to earth. The water that circulates in trees and plants, if left to rot, becomes earth. All vapours and exhalations come under the idea of water, which being allowed, I think heat and air may be accounted for. The ſun, as a body of light, has perhaps in its nature a principle heterogeneal to the earth and water; and as it acts on the ſurface of the earth, produces an effervеſcence, which produces the heat that we erroneouſly ſuppoſe proceeds from its orb. I am convinced that heat does not extend many miles from the earth's ſurface; I am inclined to think not more than two; and that the coldeſt part of our ſyſtem is the ſun's center.

Then let us ſuppoſe the principles of nature may be reduced to two, viz. Matter denſe, and ſubtil, with their reſpective principles or eſſence, the ſun and earth. All bodies partaking chiefly of either nature, may have a reſpective tendency or ſympathy to their own centers, as well as a reſpective repulſion, or antipathy, for their mutual preſervation. I ſuppoſe the efficient quality of the ſun, a certain compact eſſence, creative of heat, though in its nature cold, of the earth, vapour; the union of theſe perhaps conſtitutes the air; the natural tendency of thoſe bodies to the earth's center, which have that natural tendency, would ſhew the ſympathy and homogeneality of their nature. I would ſuppoſe the emanations from the ſun not its eſſence; (which may be very different from what we conceive it) for by experiment we find, that two cold bodies produce heat, without its being a quality of either ſeparately; perhaps its rays falling in a certain direction upon heterogeneous matter, may produce that heat we feel in ſummer, when the fermentation produced by its rays is ſtrongeſt. We know from fact, that fermentation produces heat, it is therefore as reaſonable to ſuppoſe the ſun a ſelf-exiſting body of light, as an amazing fire kept up with the contingency of inflammable matter. The idea is ſurely extravagant, to ſuppoſe that a fire equal to the ſun's diameter, would be maintained, ſuppoſing our ſyſtem entirely made of materials proper for that conſumption. Let us ſuppoſe with Moſes, that at the firſt arrangement of matter, that great ornament of our ſyſtem was created light, not fire. This theory would by no means infringe upon the axioms of the many great and learned men, who have explained its nature relatively to our ſyſtem, by its attraction and repulſion. I would ſuppoſe thoſe powers the ſame, was it light, or fire; which powers continually acting, maintain the equilibrium between the ſun and earth; the rays, or the ſun's emanation, I would ſuppoſe, in conſtant circulation from its center to the earth, where meeting with heterogeneous matter, they cauſe a fermentation, which produces all the phænomena of nature, ſuch as heat, rain, thunder, &c. I would ſuppoſe, that it acts as an univerſal cauſe, relative to the earth and its material contents; firſt, from its ſubtilty it pervades the earth, cauſes the vegetation neceſſary for plants; pervades ſtill further, and performs all its functions deeper in the earth, below which perhaps the cold joins its powers, and form minerals, earthquakes, &c. As extravagant as the idea may ſeem, I think all the phænomena of nature may be as eaſily explained, and ſome better. 'Tis obſerved, that hail uſually falls in ſpring and ſummer; I would ſuppoſe, that the ſun's approach exhilerates the fermentations, by which means thoſe rays that have performed their operations in and upon the earth, as they are preſſed upon by ſucceeding rays, having performed their natural operations, are perhaps rarefied, of courſe they mount in the general fermentation, loaded with heterogeneous matter, which it gradually leaves as it mounts into the atmoſphere, till it is diſengaged of the heterogeneous matter; it then becomes impregnated with the powers of the general maſs, and returns with it to reperform its functions. I ſuppoſe then, that theſe particles in the courſe of their attraction to the ſun, leave in the atmoſphere the vapours that cauſe rain, thunder, lightning, &c. that ſtill after this, there remain adhering to them, ſome particles of heterogeneous matter, of which they may not be able to diſengage themſelves, till they mount where the fermentation almoſt ceaſes, of conſequence where the cold is intenſe; there perhaps they are entirely diſengaged of this heterogeneous matter; which matter, by ſympathy and mutual attraction unite, till their gravity in theſe cold regions, and natural tendency to their own center taking effect, they fall from one to the other, in their progreſs, increaſing their bulk till they fall to the earth in hailſtones of the ſizes we ſee them; that this happens in the ſummer, appears to me from the vigour of the fermentation, the matter being carried higher into the atmoſphere, during the ſummer, the exhalations, for obvious reaſons, being more frequent, and the air more rarefied, the groſs particles do not riſe beyond a certain moderate diſtance, then fall in rain and dew: other particles are carried higher, where they form into ſnow, but falling a conſiderable ſpace through a heated medium, they become rain before they arrive at us. I would ſuppoſe, there is ſtill remaining to the circulating rays of the ſun, certain ſubtil particles which do not diſengage themſelves till they arrive where the fermentation almoſt ceaſes, and where the emanation is almoſt pure; here, I ſuppoſe, theſe fine ~~ſubtil~~ particles being entirely diſengaged, they attract each other falling through the freezing ſpace, they accumulate to a conſiderable ſize; which I ſuppoſe diminiſhed in falling through the heated medium next the earth. I am more inclined to think this, as we perceive the ſun in winter has not power to raiſe the vapour, it being always near the ſurface in fog and groſs vapour. The ſnow we ſee on all high mountains, are an apparent proof that the ſun is not hot; can we ſuppoſe, that half a mile perpendicular height, can make that difference? 'tis natural that a plain ſhould be hotter than a ſummit of a mountain; but it appears to me more reaſonable, that it ſhould proceed from another cauſe; the heterogeneous matter coming from all ſides, and blending with the ſun's beams, creates a ſtronger fermentation; the circulation of air being leſs, the fermentation of courſe ſtronger: whereas, approaching the ſummit of hills, they leave the earth's convex; of courſe all they mount is ſo much above the earth's orb, of conſequence the chief powers of fermentation are below, the feeble effects of which they have with the partial fermentation of the hill, or mountain they are near, which diminiſhes as they mount. It appears to me, that theſe mountains are covered with ſnow, not from want of reverberated heat, but from want of a ſufficient fermentation: the exceſſive cold at the poles might be brought as an argument againſt what I advance: If the heat is produced by fermentation, why ſhould the Poles, (where they have three months ſucceſſive ſunſhine) be colder than between the Tropics, where day is never above fifteen or ſixteen hours: I would ſuppoſe, that the rays of the ſun act at a greater diſtance from their center, therefore weaker; they act alſo divergently, therefore weaker; they have likewiſe to counteract the effect of the exceſsive cold during the long abſence of the ſun. I am inclined to think, that the vaſt body of ſnow and ice that cover the ſuperficies of the earth, homogeneal with the rays of the ſun; for the above reaſons, we muſt think the fermentation raiſed by the ſun's rays, to be at firſt very weak; though I ſhould think, by the conſtant action of the ſun's beams diſengaging the heterogeneous matter contained in the ice and ſnow, the heat produced by this conſtant fermentation, might in the end of July be as intenſe as in any part of Europe, was it to ariſe from the heat of the ſun, I ſhould think it inſupportable: if the rays of the ſun were heat, a very ſmall portion would in ſummer free the tops of the hills of ſnow, and would have a different effect in proportion to the diſtance: but we find the ſame effect produced upon the Alps in Europe, as upon the Andes, under the line, in South-America, the diſtance from the earth's convex, and the heterogeneous matter that cauſes the fermentation, ſeems to me to mark the degrees of heat. Whether electricity is not a further proof of this propoſition? I ſuppoſe the glaſs ball, the earth turning on its own axis, the pad contains the homogeneal and the heterogeneous matter that ſurrounds it, (for I ſuppoſe the ſun's emanation always exiſting, though inefficacious without light) the violent friction of theſe bodies produces heat, which heat produces light and fire, it appears clearly to me both; if the electrified bar is touched by any perſon ſtanding upon a cake of wax, the electrical fire would exiſt in that perſon without his feeling a difference of heat, though if the fermentation was increaſed by friction, the power of the fire might become fatal; if then friction with the circumambient matter can produce heat, which heat light, may not vice verſa light produce heat, acting jointly with the ſame matter? which light may be of the ſame ſelf-exiſting nature with the ſun. This I think would likewiſe account for the phænomenon of the burning glaſs in like manner; the extra fermentation cauſed by the condenſed rays, correſponding to the friction of the glaſs ball and pad, the rays falling through the burning glaſs, and being collected into the focus, in proportion to the collected rays, is (I think) the extra fermentation and degree of heat. It appears then to me, that an extra fermentation will collect this emanation, even out of the ſun's light, ſo as to produce a flame of (as I ſuppoſe) the ſun's nature; this emanation naturally exiſts for the neceſſity of nature, being ſcattered and mixed with heterogeneous matter upon the earth's ſurface, which may be collected in the manner we ſee it done in electricity, and as I have ſeen it done with certain ſtones in Italy, which, being put into the light for a little time, imbibe the rays, and become luminous; being put into the dark they loſe the light, but acquire it again by being put into the light. In theſe two inſtances we ſee light produced without heat, excepting that proportion contained in the atmoſphere, of which it muſt partake. It appears to me, that heat and fire are the effects of ſome cauſe; as for example, heat and fire are the effects of the ſun; heat and fire are cauſe and effect to each other. I ſhould be glad to know the cauſe of cold—it may be ſaid, the abſence of the ſun: it is then to me clear, that cold is ſelf-exiſting with light, and that fire and heat are raiſed from the fermentation cauſed by the ſun's rays falling upon a genial bed of vapours, adapted for the purpoſes, as the earth is for the ſeed of plants. It is from obſervation we find in nature nothing uſeleſs; cauſes and effects cement its chain. If ſometimes we find phænomena beyond our weak abilities to diſcover, from inference we account for what ſeems wonderful; but in reaſon's eye we diſcover not only their utility but neceſſity from the laws of nature, from what we ſee in our globe. It is not ſtrange to ſuppoſe another planet can exiſt upon our own principles; it is poſſible alſo that other planets may exiſt upon other principles. I however think it as probable that they exiſt upon nearly the ſame, as they have the ſame centers. Should we ſuppoſe the inhabitants of Mercury and Venus of the ſame nature with ourſelves, and the ſun a ball of fire, it is abſurd to think that fleſh and blood can ſupport the heat, we muſt ſuppoſe them men of iron at leaſt, with hinges inſtead of joints; unleſs we ſuppoſe their ſyſtem entirely different, we muſt allow ſome hypotheſis that can make their exiſtence nearly the ſame with our own. If then we allow the ſun to be firſt light, with the neceſſary qualities for all other operations of nature, more or leſs of that heterogeneous matter which cauſes the fermentation, will account for their ſyſtem being nearly the ſame, as I think the very nature of ſoil will make a variation of many degrees of heat. Let us ſuppoſe, as the planets approach the ſun, the nature of the ſoil varies, always becoming more compact as they approach, and charged with leſs fermenting matter, ſuch as nitre, ſulphur, &c. as they recede from the ſun; on the contrary, I ſuppoſe the ſoil more open, and charged with more fermenting matter. I think, too, their diſtance from the ſun's rays may be ſo great, that an additional fermentation may be neceſſary, beſide what proceeds from the ſurface of their orbs. In this manner I would account for the belts of Jupiter and ring of Saturn; it is allowed that nature never acts in vain; it is a matter of duobt, the utility of the circles of the above-mentioned planet, and it is with diffidence I deliver my ſentiments on a matter that ſo many great men have ſceptically thought of: I, however, deliver my opinion, and leave it to others to cancel or approve it. The immenſity of the work ſhews it not for a partial but general neceſſity. What ſeems neceſſary for every ſyſtem is heat, light, and air, for obvious reaſons. For which of theſe great purpoſes theſe belts were made, can never be better aſcertained than by opinion; mine is, that it cannot be to procure light, or impede it, as I cannot find an argument to ſupport the idea of its utility; that it cannot be to procure cold, is too evident for an argument; that it may be to procure air or wind, I think it poſſible, and probable. But as it is my intention to make it as evident as I can, that heat is the bleſſing procured thoſe planets by thoſe circles, I ſhall advance what arguments I can in ſupport of that hypotheſis; if we ſuppoſe the ſun light, or fire, it is natural to ſuppoſe that its power diminiſhes in proportion to the diſtance from its center; that allowed, it will follow the rim of Saturn cannot be intended to ſcreen that planet from its burning rays; as we obſerve all the planets nearer the ſun are without them, it then appears reaſonable that it cannot be deſigned to impede the ſun's rays. I could now wiſh to prove the contrary, that its deſign is to procure heat: there are many arguments in my favour, ſuch is this, that the planets furtheſt from the ſun are provided with theſe circles, which thoſe nearer are without. As another argument, their amazing diſtance from the ſun's center, for how to prove that circles which in part impede the ſun's rays, can be ordained to produce heat, ſeems ſtrange, and cannot be allowed without this hypotheſis, that heat is the effect, not the quality, of the ſun. This allowed, I would ſuppoſe that Saturn is placed in his circle as a ball in the rim of a ſieve, with the poles to the rim; to produce the effect of heat, it does not appear neceſſary that it ſhould partake of the motion upon an axis; it is probable it may have a motion, but I think it different from the globe, that is, retarded, or accelerated. Was it to partake of the ſame movement of the planet, part of the planet would be rendered uſeleſs by being always ſhaded; on the contrary, varying the motion of one from the other, the whole planet would receive equally the ſyſtematical benefit. The ſun acting at ſuch an amazing diſtance from its center, I ſuppoſe its emanation ſo weak, that the fermentation cauſed on its ſurface inſufficient for the purpoſes of nature. To obviate this inconvenience, I ſupppoſe the Divine Being formed this rim of ſuch materials, as abound with heterogeneous matter of ſuch a nature, perhaps, as renders it uninhabitable, and which would have rendered the planet itſelf the ſame, had the neceſſary fermentation been made on its own ſurface, without the aſſiſtance of the rim: if we may judge from analogy, theſe rims may be compoſed of rocks of ſulphur, ſo that the planet, by the revolution of its rim, is incloſed in a warm atmoſphere, through which the ſun's rays paſſing, they receive a temperature, which prepares them for the operations upon the ſurface of the planet, and produce that heat neceſſary for vegetation.

It ſeems to me, that light and darkneſs are coeval, but not coequal, that is, the ſeeds of light (if I may be allowed the expreſſion) or the ſun's emanation exiſt in darkneſs, weak and ineffectual; that theſe rays are rendered luminous, not by the progreſſion of light from the ſun's body, but from a ſympathy of their nature, ſimular to that of the loadſtone and iron, where reciprocal attraction always exiſt, though not in contact or operation. Whether darkneſs would not be the effect immediately on the ſun's ſetting, which darkneſs would continue till the ſun was above the horizon, and then thoſe parts only would be luminous, obvious to its rays; all other would continue in entire darkneſs, and nothing would be viſible out of the ſun's immediate light; its ſympathy produces the ſhades of light, without which, light and darkneſs would be co-exiſting, and no part luminous out of its rays; and the very ſhadow of an atom would create utter darkneſs. The common occurrences of life produces frequent inſtances of improvement, when reflection takes place of what, in the firſt opinion, is the infant of the brain, and receives the ſtamp of its value from the conſideration of the head that gave it birth. 'Tis the wiſdom of every age, and baſis of every art and ſcience; with it the ancients ſupported their ſchools of philoſophy, and raiſed a reputation revered even at this day; with it the world has been enlightened, and ſtill may be more ſo, conſidering the ancients, as well as moderns, had the ſame ends to attain in nature, policy and morality; the ſame open road to advance in, yet opinion led different ways with the ſame object in view, they adopted various principles to obtain the ſame end. If in the ſearches after truth from the moſt early time to the preſent; men of the greateſt abilities ſhould differ, may not the ſame appear in our own days? may not the hypotheſis of any general received notion be ſet aſide by the opinion of ſome other, ſupported by better proof as well as argument? Excepting the mathematics, it is prejudicial to ſcience to ſuffer any ſyſtem incontrovertible; every age has ſhewn the fact. Among the Greeks, each of his day had his followers in ſucceſſion; the ſame among the Romans. After the fall of the Roman empire, ignorance prevailed all over Europe: as ancient Rome had reigned by the ſword, modern Rome adopted a new plan of governing the minds; as this power was raiſed by univerſal ignorance, the holy See could not better eſtabliſh her power, than by impoſing upon the ignorant with the awe of wiſdom and learning; this indirect method, was perhaps the means of introducing learning into Italy, from thence it ſpread itſelf to the neighbouring ſtates; the circumſtances of the times, helped much to advance the progreſs of the arts and ſciences; there was not that abundance of books, which miſlead a man capable of forming his own opinion from nature and reflection, ſuch were Gaſſendi and Torricelli, their happy obſervations gave a ſpring to ſcience, and every man thought for himſelf, leaving the ancients, and choſe nature for their guide. Though many uſeful obſervations in philoſophy have been made, yet light has not been conſidered as diſtinct from fire; the ſun, from its conſtant action upon the earth's ſurface, forms a general warm bed for hatching and bringing to maturity the ſpawn of the aerial atoms, theſe have their period and die, and fall to the earth, either from their natural gravity, or impelled by the fall of rain and dew. I ſuppoſe further, that the ſun by its continual action upon fluids, in the courſe of repeated operations, part of the vapour becomes ſolid, as we find by repeatedly boiling water, part becomes ſtone; how otherwiſe can we account for beds of oyſters and petrified fiſh, found on the tops of mountains, near Verona, in Italy? I cannot think it a concluſive mark of the deluge, for if the oyſters were not there before, I cannot think that during the deluge, the oyſters could have travelled from 150 to 200 miles from the ſea coaſt to the ſpot near Verona, where they now are, as I apprehend oyſters cannot move far from the place of their firſt exiſtence; the method of preſerving oyſters in beds prove the ſuppoſition. To explain the above, I ſhould imagine that the globe was originally much more covered by the ſea than at preſent; by the repeated exhalations of the ſun, part of the exhalations have become ſolid, which falling to the earth, increaſe the maſs, or falling into the ſea, help imperceptibly to fill it up, as the water by exhalation diminiſhes, ſo the maſs of earth increaſes. I ſuppoſe then, that the ſea muſt formerly have covered thoſe hills where oyſter ſhells and petrified fiſh are found, and that the encroachment of the earth upon the ſea by the exhalation, will be more rapid every year, as the exhalation does not appear to me to diminiſh in proportion to the ſpace filled up; if this has been the caſe, the effect will continue as long as moiſture continues in the earth for the exigencies of nature; when the ſun, by its repeated operations, has turned the fluid into a ſolid, it will loſe the power of ſupplying the earth with rain; which leads me to think, that the diſſolution of matter will be a natural effect, not produced by a preternatural cauſe; for if the fluid loſes its nature in theſe operations, the effect will be, that the earth muſt be deſtroyed by heat; or if it is, as I imagine, an immenſe ball, containing an immenſe ſpace, the rarefaction of the external air, by the exceſſive heat, will cauſe it to burſt like a bomb. However extraordinary this may appear, the concluſon is natural, from the knowledge we have of the viſible effects produced for the arrangement of the material ſyſtem.

If the fiat of the Supreme Being is all that is neceſſary for the creation, progreſs, and continuance of his works, is it not reaſonable to conceive the Divinity the firſt great cauſe of all things; his will the ſecond, modifying matter conformably to his ideas; his will is then the diſpoſal of matter in the different forms and manner as repreſented through the univerſal ſyſtem; to make this diſpoſition the more wonderful, would be to reduce it to one ſimple principle, which is matter; the modification of which, is as various as the ideas of the Creator in the created: if matter is the conſequence of the will of the Supreme Being, its exiſtence muſt depend upon the cauſe of its creation, it is either mortal or immortal, as the power conſtituting it ſhall ſee fit: though theſe obſervations may appear extravagant, it is becauſe they have not the corroboration of our ſenſes in ſupport of evidence; whereas daily wonders, that have the evidence of our ſenſes, are unnoticed, becauſe experience has uniformly confirmed the truth beyond the power of a contrary conviction. I ſhall beg leave to ſtate a fact (in confirmation of my hypotheſis) that happened in Charles-Town in North America. Sometime about the middle of February, a baſon of water was left in my chamber, the windows were ſhut, and curtains drawn, and the external air excluded as well as could be, in the morning I found in the baſon a compact ſolid cake of ice, and not a drop of water viſible in the baſon; this circumſtance I confeſs amazed me, as the ſun was at that time within 40 degrees of the meridian of Charles-Town, and within 10 degrees as near as it is to us at the longeſt day; this circumſtance in Europe would appear incredible, as it ſhews the moſt extraordinary change of climate in a ſhort time that ever I heard of, although in thoſe parts it is frequent; the day following, before midday it was as intenſely hot as I ever remember to have felt it in Europe at any time; had this circumſtance been caſual, it might have been difficult to explain,

plain, but it being there common, it is natural to ſuppoſe ſome cauſe neceſſary to produce the effect; we ſee in the ſpace of twelve hours the extremity of ſummer and winter: the town of Charles-Town is in 32 degrees of latitude, of conſequence the diſtance of the ſun from the meridian of Charles-Town was much about 40 degrees; the diſtance of the ſun from the meridian of London in the ſummer ſolſtice, is about 30 degrees, in the month of February about 60 degrees; we find in the month of February in Charles-Town, a degree of cold not known in the latitude of London in the depth of winter; we find alſo a degree of heat in a place 40 degrees from the ſun, ſuperior to what is felt in England in the hotteſt months. I cannot ſuppoſe the heat produced from the ſun as an heated body, ſince it would be moſt natural to ſuppoſe, that the nearer the ſun, the more powerful the effect of heat, with the advantage of twilight to the latitude of London, which I think in ſome degree maintains the heat; but on the contrary, we find the effects contrary to the apparent cauſes; it is then neceſſary to find out another, that has ſome reaſonable appearance of truth: I ſuppoſe the ſuſpended vapour, upon the ſetting of the ſun, loſes the cauſe of attraction and fermentation, the conſequence of which is, that they fall to their own center the earth, with their natural qualities, I ſuppoſe ſulphur and nitre the chief ingredients of this vapour, both abſtractedly cold, without the active power of the ſun they gradually become of the nature of the ſurrounding atmoſphere, more rapidly ſo perhaps from the greater quantity of nitre in the exhalation: was the heat progreſſive from the ſun, I cannot think that the heated atmoſphere between the ſun and earth could be ſo ſoon deprived of its heat, as to produce ſo ſudden an effect; if this ſudden effect is produced in February, why not in the months of Auguſt and September, when the nights are as inſupportably hot as the days? I ſuppoſe, that the ſun, as it approaches the northern tropic, increaſes its power of attraction by the direction of its rays, as well as by the duration of the day; the atmoſphere is raiſed gradually higher to a certain diſtance, of conſequence the heterogeneous matter that cauſes the heat is longer in falling, and before the cold region can have invaded the earth's ſurface, the ſun has recommenced its operation; this I think the reaſon that the contraſt of climate in ſummer is not ſo great as in winter: the implicit belief in the dogmas of the ancients has been the means of keeping us much in the dark with regard to the ſecrets of nature; if we ſurvey the the univerſe with a philoſophic attention, we ſee ſuch wonderful regularity in all the effects, that we are diſpoſed to think the wonderful Architect has formed this machine without complication, yet dependant upon ſimple ſecondary cauſes; as the ſun is the ſupport of all matter, I think all the elements derived from the ſun, and all vegetation ſupported by its influence.

The uſe and nature of comets are not yet a received axiom, though many have wrote upon the ſubject: the immortal Newton, in a paroxiſm of genius, has let his brilliant imagination invade his better judgment, what can we think of this illuſtrious character, in the depth of his reverie, giving an account of the proportions of the heat of a comet, as though ſeated in the planet with the thermometer in his hand: heat muſt, as well as every thing elſe, have its extreme; and how is it poſſible for human calculation to aſcertain, that the body of a comet ſhall be 2000 times hotter than redhot iron, appears to me a Pegaſean flight, equal to Deſcartes, or the moſt romantic philoſopher that ever lived. I can humbly conceive, that there may be a ſyſtem of comets, and by their returning at different periods, I do not think unlikely; if there is, their orbits muſt be immenſe, which may be the reaſon of their being intruders in other ſyſtems beſides their own; but why we ſhould ſuppoſe, that the comets formed by the ſame Creator as the planets, ſhould be permitted to undergo all the miſeries of fire 2000 hotter than redhot iron, cannot eaſily be accounted for; yet, perhaps it is not ſo, and all theſe miſeries exiſt only in the brains of philoſophers: heat is produced in proportion to the compactneſs of the nature of matter, if ſo, the ſun muſt be of a nature ſo compact, as we can have no idea of, to contain in itſelf a heat ſo immenſely great, that it can beſtow on a tranſient body, a heat 2000 hotter than redhot iron. I would rather ſuppoſe, that a comet has naturally a much greater ſhare of that heterogeneous matter which produces heat on the earth's ſurface, that the nature of the ſoil may be more open, (for I think on that the degrees of heat very much depend) of courſe the fermentable matter may be more eaſily drawn out by the ſun's rays, and the heat becomes more intenſe; though comets ſeem eccentric by their occaſional appearance, I doubt not but they have a ſyſtem of their own, but their orbits being ſo exceſſively great, it may require an hundred years, perhaps more, to make their revolutions round the center of their own ſyſtem; in making their orbits, they may paſs through many other ſyſtems beſide their own, and their approach to our ſun, may give them the appearance of eccentricity, and an hyperbolical progreſs imputed to them, though in fact, they deſcribe true circles to their own center, which I am inclined to think all planets do, whatever appearance there may be to the contrary: if nature is uniform, (which I believe will be allowed) the attraction and repulſion muſt be ſo too; if the attraction is uniform, the planet muſt keep equidiſtant from its center, if it does, the revolution of the planets muſt be circular, not eliptical, as generally imagined. The ſtream of light that follows comets, it is imagined proceeds from the heated atmoſphere of the planet, which I think too, and which is not inconſiſtent with my hypotheſis of the ſun's coldneſs:

it may perhaps be neceſſary at certain periods, according to the deſign of the wiſe Creator, that comets ſhould approach the ſun ſo near, that the heat of the comet may have power enough to diſengage the ſun's diſk of thoſe opaque appearances, that have at times threatened the world with a total privation of its ſalutary bleſſings of light and heat; nor is this hypotheſis more ſurpriſing, than to think that a comet approaches the ſun with a ſupply of inflammable matter, to keep up an amazing fire of the ſun's diameter, ſuppoſed to be eighty millions of miles. If from the foregoing obſervations any thing beneficial to the public can be derived, the author will think himſelf extremely happy; if not, the indulgence due to the beſt intentions, ought to be his reward and protection; he, notwithſtanding, flatters himſelf that the above hints, under the correction of abler men, may bring to light truths, at preſent hid among the ſecrets of nature.

FINIS.